EXTERNAL DOSIMETRY TECHNICAL BASIS DOCUMENT

This operational plan:

1. Addresses the technical basis for external radiation dosimetry used at Ames Laboratory.
2. Provides guidance for assignment of the different types of dosimeters to users.

Comments and questions regarding these procedures should be directed to the contact person listed below:

Name: Stephen A. Simpson
Address: 119 Spedding
Telephone: 294-7926

Sign-off Record:

Approved by: _____ Date: _____
ESH&A Health Physicist

Approved by: _____ Date: _____
Manager, ESH&A Office

1.0 REVISION/REVIEW LOG

This document will be reviewed every three years as a minimum.

Revision Number	Effective Date	Contact Person	Pages Affected	Description of Revision
0	12/15/00	Simpson	All	Initial Issue

2.0 PURPOSE AND SCOPE

This plan provides information related to the scientific and technical basis for the external radiation dosimetry program of Ames Laboratory and provides guidance for the assignment of specific external dosimetry type based on radiation exposure conditions. The Health Physicist Group (HPG) of the Environment, Safety, Health & Assurance Office is responsible for implementation of the Ames Laboratory external dosimetry program.

3.0 PREREQUISITE ACTION AND REQUIREMENTS

Definitions:

DOELAP

The Department of Energy Laboratory Accreditation Program. This program defines a set of reference performance tests and provides a description of the minimum levels of acceptable performance for personnel dosimetry systems and radiobioassay programs under DOE-STD-1111-98, DEPARTMENT OF ENERGY LABORATORY ACCREDITATION PROGRAM ADMINISTRATION (DOE 1998b).

NVLAP

The National Voluntary Laboratory Accreditation Program. This program defines a set of reference performance tests and provides a description of the minimum levels of acceptable performance for personnel dosimetry systems and radiobioassey programs under ANSI N13.11, ANSI N13.30, and other appropriate standards and guides.

4.0 POLICY STATEMENT

Ames Laboratory utilizes contracted services from Landauer, Inc. an NVLAP (National Voluntary Laboratory Accreditation Program) accredited company. Ames Laboratory accepts Landauer's processes as derived from a sound and approved scientific and technical basis by virtue of NVLAP accreditation. Ames Laboratory's external dosimetry program is not required to have DOELAP accreditation, since it has been given an exception from DOE, which is on file (and attached to this plan).

5.0 PROCEDURE PREFORMANCE

Ames Laboratory provides external dosimetry monitoring devices to detect alpha, beta, gamma, and neutron radiation. Three general categories of radiation sources are encountered at Ames Laboratory: 1) special nuclear or source materials, such as thorium, uranium, depleted uranium, and small amounts of transuranics; 2) other radioactive materials used in calibration of instruments, activation products, and neutron sealed sources; and 3) analytical x-ray systems.

Three dosimetry devices are utilized to monitor personnel exposures at Ames Laboratory. Type P is a whole body badge, Type U is a TLD extremity badge and Type J is a neutron whole body badge. These devices are characterized as follows:

- **Type P, *Luxel® OSL Dosimeter* (Whole body badge)**
  This "optically stimulated luminescence" (OSL) dosimeter measures radiation through a thin layer of aluminum oxide. A laser light stimulates the aluminum oxide after use, causing it to become luminescent in proportion to the amount of radiation exposure. Key features of this technology include: complete re-analysis to confirm the radiation dose measurement, imaging of unique filter patterns that provide qualitative information about conditions during radiation exposure, large dynamic measurement range, increased sensitivity, and long-term stability.
- **Type U, *TLD Ring* (TLD extremity badge)**
  The thermoluminescent dosimeter (TLD) ring dosimeters provide accurate monitoring of extremities for x, gamma and beta radiation. The TLD rings provide identification integrity and are easy to use. The TLD is enclosed in the laser-etched cover. The cover provides permanently engraved identification, which can not peel, smear or wash off. Ring TLD specifications include:
  - 100% TL grade lithium fluoride dosimeter.
  - Exposure range per standard ring: 30 mrem to 1,000 rad for X and gamma radiation; 40 mrem to 1,000 rad for energetic beta. Detection outside these ranges can be arranged as necessary.
- **Type J, *Neutron Dosimetry* (Luxel® with neutron whole body badge)**
  Neutron dosimeters span the full spectrum of energies found in neutron environments. No one dosimeter is useful for monitoring the complete range of neutron energies. Landauer has found it practical to offer a series of neutron dosimeters, each designed for a particular application to ensure precise and accurate radiation measurement. In order to simplify the situation, the range of the Neutrak 144 dosimeter was extended to span energies from 40 keV to more than 35 MeV. The Neutrak 144 is a Lantrak® (allyl diglycol carbonate) based, solid state dosimeter, which records recoil protons resulting from neutron interactions in the dosimeter. It is not sensitive to beta, x or gamma radiation, and is incorporated into Landauer's Luxel® dosimeter in an integral, one-piece design. It can be used for monitoring personnel working with unmoderated or moderately shielded fast neutron sources such as Californium-252 and Americium-241 Beryllium.

Neutron Badge technical specifications: include:

- Energy range: 40 keV to over 35 MeV.
- Minimum neutron dose reported: 20 mrem.

The following process is utilized to guide the implementation of the Ames Laboratory's external dosimetry program:

The Health Physics Technician assigns dosimeters to workers based on the types of radiation and/or quantities of radioactive materials to be used and the Radiation Safety Officer reviews all badge assignment decisions.

- Workers using cabinet type x-ray systems are issued two Type U badges, one for the right and one for the left hand, because they will be working with x radiation where their extremities may potentially be exposed to the collimated beam.
- Workers using walk-in x-ray systems are issued two Type U badges and one Type P badge for whole-body exposure monitoring due to potential exposures to the primary and scatter radiations present inside the enclosure.
- Workers using radioactive materials may be issued one Type P and two Type U badges because they may be working where their extremities and whole body can potentially be exposed to beta and gamma radiation.
- Workers involved in the use or inspection of neutron sources are issued one Type J badge for measuring potential whole-body exposures to neutrons as well as beta, gamma, and x radiations.
- Workers involved in work associated with legacy radioactive contamination in Ames Laboratory buildings, which has been well characterized, emits small amounts of alpha, beta, and gamma radiation are issued one Type P badge.

6.0 RECORDS

Individuals are monitored in accordance with 10 CFR 835.402; therefore, appropriate records, as required by 10 CFR 835, are maintained to document the doses received. Quarterly monitoring results, annual reports, and other records related to the dosimetry program are maintained.

7.0 REFERENCES

10 CFR 835
DOE G 441.1-4, External Dosimetry

8.0 ATTACHMENTS

Attachment 1 DOE memorandum dated June 16, 1989, "Exemptions for Specific Chicago Operations Office Organizations from Department of Energy Laboratory Accreditation Program (DOELAP) Requirements"

Attachment 1

United States Government — Department of Energy

memorandum

DATE: JUN 16 1989

REPLY TO ATTN OF: EH-352

SUBJECT: Exemptions for Specified Chicago Operations Office Organizations from Department of Energy Laboratory Accreditation Program (DOELAP) Requirements

TO: Roger A. Mayes, Director
Environmental, Safety, and Health Division, CH

We have reviewed your April 12, 1989, request for exemptions from DOELAP accreditation by substitution of the National Voluntary Accreditation Program (NVLAP) for several Chicago Operations Office contractors.

R. S. Laudauer dosimeters accredited by NVLAP may be acceptable to DOE as delineated in Section 5 of the Handbook for the Department of Energy Laboratory Accreditation Program for Personnel Dosimetry Systems (DOE/EH-6026). However, a documented onsite assessment of each laboratory's dosimetry program is required to verify its adequacy. The onsite visit should assess the quality assurance, documentation, and technical aspects of the personnel dosimetry program,

Appendix B of the DOELAP Handbook contains onsite assessment criteria. Some of these criteria will not be applicable to a contractor's program where dosimeters are provided and processed by a commercial vendor. However, relevant criteria include: (1) justification for dosimeter selection and nonapplicability of irradiation test categories, (2) quality assurance program, (3) documentation, and (4) recordkeeping.

We believe quality assurance programs for contractors not performing in-house dosimetry should include the quality of the dosimetry program required under contractual arrangement with the vendor. This includes, but is not limited to, the nature of the dose reports, timeliness of processing/reporting, quality control data kept by vendor and made available to the contractor when requested, and the right to use blind audits to verify continued quality. With regard to timeliness, the periodic reports and other reporting requirements of DOE 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements," must be met. This is particularly important in cases where the vendor maintains dose records for the contractor.

The onsite assessments should be conducted by your office. If necessary, you may elect to utilize DOELAP assessors for this purpose. Dr. R. Douglas Carlson, the Performance Evaluation Program Administrator of DOELAP at the Radiological and Environmental Sciences Laboratory (RESL), is ready to provide such assistance. We recommend that the initial onsite assessment be conducted within 1 year. Please forward copies of the onsite assessment report to Dr. Carlson and Mr. Ken Ferlic, the Headquarters DOELAP Administrator.

Pending completion of the onsite assessments, an exemption to the requirements of DOE 5480.15, "Department of Energy Laboratory Accreditation Program for Personnel Dosimetry," is granted for the following contractors:

1) Ames Laboratory

2) Solar Energy Research Institute

3) Massachusetts Institute of Technology (MIT) Plasma Fusion Center (this does not include the MIT Bates Linear Accelerator dosimetry program).

4) University of Michigan

5) University of Notre Dame

6) Sloan-Kettering Institute

7) Washington University

8) University of Wisconsin

9) Environmental Measurements Laboratory

If you have any questions, please contact Mr. Ken Ferlic at (FTS) 233-5623 or Dr. DeVaughn Nelson at (FTS) 233-5608.

Frank E. Tooper

Frank E. Tooper
Acting Director
Division of Operational Standards
and Analysis
Office of Safety Policy
and Standards

cc:
K. Ferlic, EH-352
D. Nelson, EH-352
R. Douglas Carlson, RESL
P. Neeson, CH